SCIENCE.

FRIDAY, DECEMBER 18, 1885.

COMMENT AND CRITICISM.

THERE IS A POPULAR BELIEF that demand begets supply. If this be true, it would appear that the demand for good maps and atlases of this country, on small scales, is very limited. In respect to culture, the published maps are fairly good, although in detail they are not what they should be, even in this respect. In their representation of natural features, however, they are, as a class, subject to severe criticism. It is not too sweeping an assertion to say that there is scarcely an atlas of this country which is abreast of our geographical knowledge, or even within several years of it. Indeed, in atlases dated '1884,' there are to be seen maps of the western states and territories, in which all geographical work, executed subsequent to the Pacific railroad explorations, has been ignored. The charitable might assume that the compilers were not aware of the existence of later and better material, were it not for the fact that in many atlases the same area is represented a second time by maps compiled from material of much more recent date. One must conclude that the same old plates have been made to do duty these many years, and that, while the culture has been revised from time to time, the natural features have not been considered of sufficient importance to warrant revision. On the most recent maps one still meets with the old familiar errors. The mouth of the Rio Dolores, in eastern Utah, is still frequently represented thirty miles out of place. The mythical island in Green River, in the Green River basin, is occasionally seen; and Sevier Lake, Utah, is sometimes accompanied by its double, the so-called 'Preuss Lake.'

But it is not in this respect alone that our maps and atlases are subject to criticism. As a rule, the representation of the relief is a dismal failure. There is scarcely a map published by private parties which gives even a fairly good picture of the orographic features of the country. No attempt is made, by means of contours, at a quantitative representation of relief, but hachures and crayon, or brush-work alone, are employed. In most cases the expression is in the highest degree conventional, a double line of hachures representing a range, and an asterisk a peak. When an attempt is made to represent properly the forms of relief, it is seldom successful. Through the ignorance of the compiler, the great ranges are belittled, while minor ridges take on an importance altogether disproportionate to their size. Every divide between drainage systems is represented as a mountain range. Plateaus appear as ranges, and ranges as plateaus. Another feature to be condemned is the raw and glaring colors by which the states, counties, etc., are distinguished from one another. If colors must be used, let them be subdued tints, which will not offend the eye, or render the map illegible. Many American maps and still more foreign maps are rendered almost illegible from the quantity of material which they contain. The names are so numerous as to obscure all other features, while the lettering is often so fine that it can be read only with a microscope. A map should be as legible as print. There is certainly room for improvement in the compilation and publication of maps.

IN THE INAUGURAL ADDRESS of President Adams of Cornell, reference is made to the need for the establishment of regular courses of instruction in the history and science of education at that university. According to the census of 1880, there are in the United States 64,137 lawyers, 64,698 clergymen, 85,671 physicians, and 277,710 teachers. For each of the first three professions we demand a more or less special training. Sometimes we ask much, sometimes little; but we always require something, and in the more cultured sections of the country that something is a great deal. With our teachers the case is, or it may be more just to say has been, radically and incomprehensively different. Any person who chose could start a school, and various influences aside from special training served to secure responsible positions in institutions of learning. Teaching may, and perhaps does, require what we are used to hearing called a knack. But on what principle is it that teachers are not required to possess a scientific knowledge of their

profession? That profession is not a fungus, but a gradual development. It has a history, it has a literature, and it has a profound philosophy. How many of our two hundred and seventy-seven thousand teachers know any thing of these? We are forced to believe that this number can be counted by hundreds, perhaps even by scores. Our great universities are the places where reform in this matter should be brought about. Let us see established in each of them courses of instruction in the history, theory, and practice of teaching. Let us hear something about the educational systems in other countries. Cambridge, Edinburgh, St. Andrew's, and other British universities have taken this step, and it has proved a successful one. It is no new thing in France; and such lectures are to be heard in almost every university in Germany. Paulsen in Berlin finds from two to three hundred hearers for his lectures on *pedägogik*, which occupy four hours per week throughout the semester. Our college presidents recognize our need in this respect, but the governing boards do not seem to carry out their recommendations. How much must be said and written on this subject before the authorities understand what is needed to round out this scheme of university education? It is safe to say that not more than three of our leading colleges now offer any scientific instruction in pedagogics.

THE GOVERNMENT AND ITS SCIENTIFIC BUREAUS.

THOSE who anticipated that the President, in his annual message to congress, would enunciate some radical views in respect to the relations of the government to its scientific work, have been disappointed. Those who know how sincerely desirous he is to uphold the efficiency of the public service have been gratified. Considering the length of his message and the obvious care which has been bestowed upon many questions, — the coinage of silver and the civil-service reform, for example, — it is noteworthy that all he has to say upon science is contained in a few short paragraphs. Two suggestions which he makes are, however, of very great importance, and deserve the most judicious consideration, — the separation of the signal service from the war department, and the transfer of the coast survey to the navy department. It is remarkable that these recommendations so opposed to one another should be included in one message, and it is by no means obvious why better administration can be secured in the one case by separating a large corps from the army, and in the other by placing a large corps under the administration of the navy. There are strong reasons for believing that both those bureaus — the signal service and the coast survey — will do better work if allowed to stand as independent corps, — that is, detached from the army and navy. The reasons for such a belief will doubtless be made known to the congressional commission which has been instituted for the investigation of this and allied subjects.

This commission, in continuation of the prolonged inquiries which it carried on several months ago, resumed its work, unless we are misinformed, within the first week of the session. It is earnestly to be hoped that all the matters which come within its view will be soon taken up, and such a report prepared as will enlighten the administration, congress, the men of science in the government service, and the public at large, upon the principles which should govern the various scientific bureaus established in Washington. These principles seem to us very clear, and we hope to see them so definitely announced during the present winter that subsequent legislation will be simplified, and future superintendence made more efficient than ever before.

It is already evident that the alarms which were sounded by some over-zealous correspondents during the last summer and early autumn were exaggerations. One important case of mal-administration was undoubtedly brought to light; but the more thoroughly that case is understood, the more obvious it is that the chief officer upon whom reproaches were cast has been long a sufferer from such serious physical infirmities, and that right-minded men should rather incline to charity than to censure in their estimate of the close of his official career. The full and frank explanations which were promptly made by other chiefs of scientific bureaus have removed the imputations which were cast upon their official conduct. It is not unlikely that congress will institute such inquiries as will reveal the exact situation, and we have not the least doubt that the utmost scrutiny will be encouraged by those whose work has been publicly impugned.

Out of all this discussion there will doubtless proceed further legislation in respect to the scientific work of the government, and probably better methods of administration will be devised than those which have hitherto prevailed. The dangers

which are liable to come from the overlapping of responsibilities and the confusion of purposes can be obviated. Better modes of appropriating money can be devised, and better assurances can be given that those who devote themselves to the government service shall not be inconsiderately superseded. But we doubt whether any system will be adopted which will secure the services of an abler corps, or, on the whole, a more faithful corps, than that which has superintended and directed the governmental work in science during the last twenty or thirty years. Any country may well be proud of the investigations in geology, in geodesy, in geography, in astronomy, in meteorology, in natural history, and in ethnology, which have been performed within that period by a staff of civilians; and to all their achievements must be added the scientific researches and studies of the able officers in the army and navy.

Whatever measures may be adopted with respect to re-organization, one principle should constantly be borne in mind. Science cannot be carried forward by prescribing too definitely the tasks of scientific men. They may be bound by appointed days and hours; they may be told to perform specific duties, — and if only the maintenance of routine work is required, such regulations may secure fidelity and efficiency. But if knowledge is to be advanced, if better methods of work are to be discovered, if greater accuracy is desired, if unknown facts are to be ascertained and recorded and discussed, and, in short, if there is to be real progress, the methods of freedom are to be employed, not those of petty regulation. By this we mean that if the great undertakings which the government has in charge, if especially its surveys of the coast and of the interior, are to go forward, discretion must be given to the chiefs of bureau, and they must be held to accountability for the aggregate success of their work. Honesty, economy, clear and accurate statement of accounts, are, of course, to be demanded in every office: nobody questions this. But the determination of what shall be undertaken in a given year, to whom it shall be assigned, what allowances shall be made for instruments, books, and assistants, — these are questions which experience and judgment must decide. Somebody who has all the facts in mind must make the determination, and he must not be too quickly condemned, because the immediate results of the investigations which he has undertaken are not yet apparent. The highest personal character should be found in every one who is called upon to direct the labors of a scientific corps; he should be faithful, watchful, careful that all the interests intrusted to him may be promoted; but he should be free within the limitations of his office to select his subordinates, determine their duties, and prescribe their methods. Only by such regulated freedom as this can the highest results be obtained. Discretion with responsibility, in all the higher work of science, will bring the best services from those whose moral attitude is what it should be: no others should be intrusted with the leadership.

THE MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

AFTER the paper of Dr. Hunt at the morning session, Tuesday, Dec. 8. (*Science*, Dec. 11), there was presented a paper on forms of tables for vital statistics, by Dr. J. S. Billings. Attention was called to the diverse forms in use throughout this country and Europe, and to the difficulties of drawing valuable deductions from a comparison due to this diversity. The health officer of a city desires information of the diseases which are liable to become epidemic, as to their location, relation to nuisances in the neighborhood, etc., in order that he may know where sanitary work is most needed. For this purpose tables are prepared which are made the basis of his study. These tables are published in the forms of bulletins or reports. Of these there are three principal forms: the weekly, the monthly, and the annual. As ordinarily issued, the weekly bulletin is too elaborate: its proper office is that of warning. If delayed, as it must be if complete and perfect statistics are to be recorded in it, its very object is thwarted, and its warning voice is not heard until after the need for it has passed. The annual form should be complete, and any reasonable delay in its issue to accomplish this is no detriment. The weekly bulletins issued by boards of health have too much the character of an annual report. It should constantly be borne in mind that they are designed for the information of the people: their main purpose is educational. They should state the total deaths, by color, sex, age, and locality; also those for certain diseases, as phthisis, pneumonia, cholera, yellow-fever, and diphtheria. In this form the unit of area is political usually, as by wards. This ward division could oftentimes with advantage be abandoned, and some other unit substituted. It is sometimes very important to have the mortality recorded by blocks, and the deaths which occur in a single tenement-house may not

infrequently be made the subject of special mention in a published report, with great advantage to the public health. The forms of cities, both American and European, were referred to as showing their great diversity. It would be better for the health officer to study the returns, and then publish through the secular press his deductions and observations. This could be done promptly, and would be of great benefit. There could then be issued a monthly bulletin, which could be made as complete as was desirable, and these monthly tables together would form the annual report. In the weekly statement to the public there should be no concealment: it should be frank and full as to the existence of communicable disease. Business interests should not be permitted to stand in the way of a free statement as to the existence of diseases liable to become epidemic, as by so doing time for preparation and protection by neighboring localities would be lost. The graphic form, as by diagram, was heartily commended as a means of education of the people, showing at a glance facts which would otherwise require hours of study. It was suggested that there be a conference of public officials having in charge these matters of vital statistics, to devise a plan by which there might be greater uniformity in the forms of tables and reports. Subsequently a committee was appointed, with Dr. Billings as chairman, to present to the association, at its next meeting, forms for the weekly, monthly, and annual bulletins.

In a paper on the relations of rainfall and water-supply to cholera, Dr. Henry B. Baker, secretary of the state board of health, Lansing, Mich., showed that the best plan to study cholera is in its home, and that if we can find any means by which its ravages have been diminished there, we may reasonably infer that the same measures adopted here will produce a similar result. With this object the history of cholera has been studied in India, with the most striking results. Six tables and diagrams have been prepared to make the subject more intelligible. Prior to 1869 surface or tank water was in use in Calcutta. During the five years 1865–69 the average deaths were 4,388 annually, in 1866 being 6,826, and in 1867, 2,270. In the year 1869 provision was made for a supply of filtered water, and in 1870 a most remarkable change was noted; the deaths in that year from cholera being only 1,558, and in 1871 falling to 796. Since 1870 there has been a marked reduction, estimated at 3,000 per annum. It was also demonstrated that during the seasons of the year when there was little rain the mortality increased, and that when the rainfall was most abundant the disease declined, even in the hottest weather. During the heated period there were 300,000 more gallons of water sent into the city, and consequently less of the tank-water used, and just in that proportion was the mortality diminished. The year 1880 was remarkable for its low mortality, there being in that year but 805 deaths. The rainfall for that year was six inches greater than the mean for forty-eight years. In the suburbs the same improvement has not been noticed. This is explained by the fact that the tank-water is still in use there. A sewerage system was devised for Calcutta in 1859, to cost $4,000,000. Thus far $3,100,000 have been expended. The following deductions may be drawn: 1. The mortality for cholera has been reduced two-thirds by the introduction of filtered water. 2. Both before and since its introduction the rainfall has exercised an important influence on the mortality. 3. If the disease has been reduced two-thirds through the improved water-supply, and if one-third depends upon the amount of rainfall, this latter might be still further reduced by increasing still more the supply of good water, so as to make the people independent of the tank-water. 4. If in the home of cholera these agents have produced such beneficial results, we have every reason to believe that similar results would follow a like course pursued elsewhere.

'The virus of hog cholera,' was the title of a paper by D. E. Salmon, D.V.S., Washington, D.C. Of all the diseases which affect animals in this country, none is more destructive than hog cholera. During the present year it has been unusually prevalent, having appeared in almost every state in the union. It has caused a loss of thirty million dollars. While it has never been shown that it is communicable to man, yet indirectly he is affected in other than financial ways. What becomes of the millions of carcasses of the animals succumbing to the disease? Large numbers are thrown into ponds and streams from which drinking-water is obtained, there to putrefy; others are converted into lard; while but a very small proportion are burned or buried. Oftentimes, when these animals first show symptoms of sickness, they are despatched as quickly as possible to market, and there slaughtered, and their meat put up by the packers. The effect of such meat upon the health of human beings is uncertain.

The questions connected with the virus of this disease are exceedingly interesting. The entire subject of contagion is very much elucidated by its consideration. Anthrax is an endemic or enzoötic disease, rather than an epidemic or epizoötic. Fowl cholera is not limited by area or soil, but is not disseminated to a distance: it must be taken in the food or inoculated. Hog cholera, on the other

hand, is disseminated through the air to a considerable distance: some claim that this may be as much as half a mile, but this is probably exaggerated. The disease known in France as 'rouget' is supposed by some to be identical with our swine plague or hog cholera. Its virus is a long and slender bacillus. Pasteur's vaccine contains this bacillus, and not the figure-of-eight form which he first described. The 'rothlauf' of Germany is characterized by a fine bacillus, apparently identical with that of Pasteur's vaccine. In rothlauf the period of incubation is shorter than in swine plague; and another difference is absence of ulceration of intestine. The author inoculated four hogs with Pasteur's vaccine: one died; the three others survived, but, when they were subsequently exposed to our hog cholera, they contracted it, and died. It is evident, therefore, that the rouget of the French, and the hog cholera of the United States, are different diseases, and that to introduce into this country general vaccination with Pasteur's vaccine would not protect our swine against cholera, but would introduce a new disease, and result in great loss and injury.

In the discussion which followed, Dr. Salmon stated, that, in his opinion, the virulence of the disease did not depend in any great measure upon the sanitary conditions with which the animals were surrounded. It was as fatal at the experimental station in Washington, where the most rigid cleanliness was practised, as elsewhere.

At the evening session on Dec. 8, Dr. James E. Reeves, the president, delivered the annual address. He especially called attention to some glaring deficiencies in the national organization. Congress had made no provision for the study of the causation of diseases that carried off tens of thousands of the people every year, and to-day we are compelled to submit to the mortification of having our children taken to Paris, where a Frenchman, Pasteur, has the only means which can save their lives. His address was an earnest plea for help to establish such a biological laboratory as the country could take pride in, for the investigation of human diseases with reference to their causation and prevention. He also deprecated the weakened condition in which the National board of health had been placed by the withdrawal of funds.

An account of the small-pox in Canada, and the methods of dealing with it in the different provinces, was given by Dr. P. H. Bryce, secretary of the Provincial board of health, Toronto, Ontario. In 1884 the town of Hungerford was visited by small-pox. Before a knowledge of its existence there was obtained by the board of health, one hundred and fifty persons were attacked; and yet so vigorous were the methods adopted to control it, that within two weeks the last case occurred. In April of the present year two cases occurred in Montreal: one was taken to a house in the city, and gave no further trouble; the other was removed to a general hospital, the Hôtel Dièu, and soon there were nineteen cases, of which seven were fatal. From this the disease spread, so that in April there were 6 deaths; in May, 10; in June, 13; July, 46; August, 239; September, 660; October, 1,391; November, 633. In all, thus far, there have been three thousand deaths, in about five hundred different houses. From the city it spread to the suburbs, where it is now prevalent. In order to prevent the introduction of the disease into Ontario, the board of health of that province sent inspectors into Montreal, and every passenger and his baggage were inspected before they passed the boundary-line between the provinces. Rags were prohibited under all circumstances, and other goods were admitted only when accompanied by the certificates of these inspectors that they were not infected. Vaccination of all unprotected persons was enforced. Although the disease was so prevalent in all the eastern parts of Canada, yet but fifteen cases have occurred in the entire province of Ontario, and not one case from infected baggage, merchandise, or clothing,— a far less number than have occurred in the city of New York in the same period, distant as it is from the centre of infection. One case had been traced to a letter.

Dr. Hingston of Montreal explained at some length the difficulties which the health officials had had in their attempts to stamp out the disease in that city. Some thirteen years ago anti-vaccination documents began to be circulated in the French language, and this has continued ever since. Every vaccination followed by any inflammatory trouble was denounced as an outrage, the inflammation denominated erysipelas, and the child declared to be poisoned. As a result of this agitation, but few of the French Canadians born during the past thirteen years were vaccinated, and it was among them that small-pox has found its victims.

'Impure air and unhealthy occupations as predisposing causes of pulmonary consumption,' was the title of a paper by Dr. C. W. Chancellor, secretary of the State board of health, Maryland. Consumption causes one-fifth of all the deaths in England, one-sixth in France, one-seventh in Germany and Austria, and one-eighth in the United States. In 1880 the total deaths in this country from all diseases was 756,893. Impure air in rooms where tailors and seamstresses worked all day, with closed windows and no means of venti-

lation, resulted in consumption in these people. In the country, consumption prevails in damp valleys and along the banks of rivers. In the city we find it most prevalent in those whose habits are sedentary, as book-keepers, clerks, salesmen, etc. It is also prevalent among file-makers, steel-workers, grindstone-makers. In the latter class, hardly one escapes. In the discussion of this paper, it came out that the mortality from consumption was greater in the District of Columbia, in proportion to its population, than in all of New England; and that whenever it occurred it was largely acquired, probably seventy-five per cent. In fact, some, Dr. Didama of Syracuse among the number, believed that it was always acquired, and never hereditary.

The evening session of Dec. 9 was opened by the reading of a paper on 'The German system of physical education,' by Dr. E. M. Hartwell, Johns Hopkins university, Baltimore.

Physical training had its origin in Germany in 1785. At present the time devoted to this part of the education must be at least two hours weekly. The effect on the development of the German youth can be imagined when it is considered that this systematic physical training continues from the age of six years to the age of eighteen in girls, and twenty in boys.

A full list of the papers was given in *Science* of Nov. 20.

The Lomb prizes were awarded as follows: —

1°. 'Healthy homes and foods for the working classes.' First prize not awarded; second, to Victor C. Vaughan, Ann Arbor, Mich.

2°. 'Sanitary conditions and necessities of school-houses and school-life.' First prize not awarded; second, to D. F. Lincoln, M.D., Boston, Mass.

3°. 'Disinfection and individual prophylaxis against infectious diseases.' First prize, to George M. Sternberg, M.D., surgeon U.S.A.; second not awarded.

4°. "The preventable causes of disease, injury, and death in American manufactories and workshops, and the best means and appliances for preventing and avoiding them." First prize not awarded; second, to George H. Ireland, Springfield, Mass.

Reports of committees on school hygiene, animal diseases and animal foods, and on disposal of the dead, were made by their respective chairmen. The latter was a *résumé* of what had been accomplished during the past year in the advancement of cremation. The 4,380 human bodies which are dissected annually in Paris at the medical school are now cremated in the cemetery of Père la Chaise. In Italy there were, during the year 1884, 396 bodies incinerated. In Spain a bill has become law, granting permission to cremate human bodies. In Germany, in 1884, 186 bodies were similarly disposed of. During the present year four persons have been cremated in England, and there is now no question there of the legality of this process. The agitation of the question has aroused the Church of England, and important reforms have been instituted in the methods of burial. One of these is the substitution, for the usual coffins, of those made from pulp or *papier-maché*, which will readily disintegrate. In France a bill is now in the chamber of deputies, legalizing cremation, and an engineer has been sent to Italy to study the best plans for a crematorium, to be built near Paris. During 1884 six societies for the advancement of cremation have been established in the United States, and two crematories erected.

Mr. Lomb offered new prizes for another year, one for plans for constructing houses costing $600, $1,000, and $1,500; the amounts to be $100 for the first, $75 for the second, $50 for the third, and $25 for the fourth.

The following officers were elected for the ensuing year: president, Dr. H. P. Walcott, Cambridge, Mass.; first vice-president, Dr. C. W. Covernton, Toronto, Canada; second vice-president, Dr. G. B. Thornton, Memphis, Tenn.; treasurer, Dr. J. Berrien Lindsley, Nashville, Tenn. The secretary, Dr. Irving A. Watson, was elected in 1883 for three years.

It was decided to hold the next meeting at Toronto, Canada, commencing on the first Tuesday in October.

METHODS OF TEACHING POLITICAL ECONOMY.

PROFESSOR LAUGHLIN opens the work which we have under consideration with these words: "The existence of this little book is due to an attempt to convey by lectures to students an understanding of the position which political economy holds in regard, not merely to its actual usefulness for every citizen, but to its disciplinary powers, and to the qualities of mind which are necessary for success in the study."

The author's treatment of methods, based as it is upon an experience of several years in the class-room, is valuable both on account of its positive information and its suggestiveness. It may be well, in particular, to call attention to those pages in which Professor Laughlin describes the advan-

The study of political economy. Hints to students and teachers. By J. LAWRENCE LAUGHLIN, Ph.D., assistant professor of political economy in Harvard university. New York, *Appleton*, 1885. 12°.

tages of the graphic method as a means of illustrating principles and presenting statistical statements, the significance of which is understood with so much difficulty by the ordinary student. Professor Laughlin recognizes the utility of history and statistics, but he treats them rather as means of illustration and verification of what has otherwise been ascertained, than as the source of new principles. Professor Laughlin also attempts to divorce ethics and economics.

A feature of the book is a 'teachers' library,' excellent on the whole, though omissions are noticeable. No history of the science is mentioned. Even such a well-known and valuable work as Thorold Rogers' 'Work and wages' finds no place, and the same is true of the works of Wagner and Knies. Communism and socialism, irrespective of the value of their theories, have assumed an historical importance sufficient to demand a careful study of their principles by teachers of political economy; yet none of their leading exponents are referred to. Under 'Reports and statistics,' the author fails to notice those valuable sources of information, the reports of the state bureaus of labor statistics, as well as other valuable state publications.

The object of the book is good, and the work is a valuable addition to our too scanty literature on the subject of method in teaching political economy.

NOTES AND NEWS.

G. P. PUTNAM'S SONS announce the publication of a monthly paper to begin January, 1886, to be entitled *The national argus.* This paper will be devoted to the discussion of questions relating to the care of the insane, the idiotic, the deaf and dumb, the blind, paupers, and homeless children.

— *Il morgagni* of Nov. 3 reports that Dr. Freire of Rio Janeiro has inoculated more than three hundred persons with a liquid culture of the yellow-fever microbe. Such inoculations are performed with five or six punctures in one arm, and in a few hours afterwards the patient complains of headache and backache, with a slight rise of temperature. Nausea and vomiting occur in rare cases. These symptoms sometimes last between two and three days, but they are never serious. The inoculations are practised on individuals who were in the centre of the infected locality. None of them died, and only very few presented mild forms of yellow fever.

— Lord Crawford cables, Dec. 16, the discovery by Gove of a new star, in the place of D. M. 20°, 1172, possibly a variable. It was of the 6th mag. on Dec. 13.

— Kane's 'European butterflies' is meant to replace Kirby's little manual published more than twenty years ago, and is, indeed, a much more complete work, with excellent illustrations of over 100 butterflies; but it is sadly deficient just where we most need help, and where Kirby did all that was then possible, for it pays no attention whatever to the early stages or food plants of these insects, any allusions to them being merely incidental. It is of value, therefore, only to a student of the old school, or the old-fashioned collector. In its details as to geographical distribution it is worthy of all praise.

— The Smithsonian institution has issued a price-list of its publications, which are no longer distributed gratuitously to individuals, as formerly; and no wonder, when they already exceed six hundred. The prices which have been affixed are high as compared to government publications in general, though an ordinary publisher would look on them as rather low. Considering the object of the institution, one is inclined to wish the prices had been made somewhat lower; and to attach any price at all to some of them, such as circulars, seems not worth the pains. Nearly a third of the publications are out of print, and therefore not embraced in the list.

— With the beginning of the coming year, the two leading meteorological journals — the Austrian and the German — will be consolidated, and will appear under the joint editorship of Drs. Hann and Köppen. The composite journal will be known simply as the *Meteorologische zeitschrift.* It will be published by Asher & Co. of Berlin.

— Dr. Latour's 'De la chaleur animale' (Paris, *Baillière,* 1885) may be described as an attempt by a person unacquainted with elementary facts in physiology and anatomy to explain the pathology and nature of fever. In reading it, one hardly knows whether to be amused by its author's *naif* self-conceit or to be exasperated by his impudence. As regards the color of the blood, we are informed (p. 13) that "it is only by mixture with carbonic acid . . . that this fluid takes the dark tint,—a tint which it gives up to resume its brightness so soon as this excrementitial gas has been rejected." It is hardly necessary to point out that the bright color of arterial blood is due to the fact that its coloring-matter is combined with oxygen; and the dark color of venous blood, to the fact that most of the haemoglobin has given up its oxygen, and that

the presence or absence of carbon dioxide has no direct connection with the phenomena in question. The well-established fact that by far the greater part of the oxidations of the animal body occur outside the blood-vessels and within the living cells and fibres of the tissues, is apparently quite unknown to our author. One hardly knows how to characterize the treatise: if written for the laity, it is charlatanry; if for pathologists and physicians, an impertinence.

WASHINGTON LETTER.

THE past fortnight has been a period of considerable activity, not to say anxiety, in the national capital. The pursuit of science withdraws men to a great degree from 'the madding crowd's ignoble strife,' and it is supposed to go on undisturbed and uninterrupted by affairs political or social. But the science of Washington is, in one way or another, almost entirely government science; and for its support, extension, contraction, indeed for its very existence, it must depend on the favor with which it is looked upon by a somewhat vacillating and fickle body of statesmen. The organization of a new congress is always a matter of much interest; but just now this is greatly enhanced by the consideration that the new body is to receive the first message from the head of a new administration, from which communication the attitude to be assumed by the ruling party towards science may possibly be inferred. This document has been before the public for several days, and comment is unnecessary; but it is not too much to say, that, in its references to the scientific work of the government, the general impression seems to be that it is not unsatisfactory on the whole, although in certain particulars it is not in agreement with the prevailing sentiment among scientific men.

The reports of cabinet officers are also looked for with interest, as they almost invariably contain recommendations, which, if carried out, affect the science of the government favorably or unfavorably. The reports just issued are, in the main, favorable to a liberal support of the scientific bureaus, and in one or two instances indications are shown of a disposition to correct certain evils which have long been recognized.

Under these circumstances, it is not surprising that scientific men should themselves be tempted to bestow more or less thought and attention upon the somewhat uncertain relation which they and their work bear to the government. The retiring president of the philosophical society, Prof. Asaph Hall, only incidentally yielded to this temptation in his address, delivered before the members of the society and invited guests, on the evening of Dec. 5. Professor Hall's topic was the scientific societies of America, and his treatment of it gave great satisfaction to his hearers. He spoke of the organization and history of some of the older and more important societies of the country, beginning, of course, with the American philosophical society, with Ben Franklin for its first president. The National academy came in for a good share of the discussion, and in this connection the general question of the relation of the academy to the government was considered, as well as that of the position of the 'government scientist.' He paid the society over which he has so satisfactorily presided the deserved compliment of declaring it to be first in importance among the local societies of America.

Only a few days later, the chemical society, a young and vigorous organization, listened to the address of its retiring president, Prof. F. W. Clarke. It was an able and entertaining *résumé* of the growth of chemistry in Washington during the past twelve or fifteen years, and it concluded with a plea for the establishment of a national laboratory, which, in its dimensions and equipment, should be commensurate with the importance and dignity of the science. Arguments to show the economy in and the necessity for such an establishment were not lacking, either in number or force. Examples of duplication or useless repetition of work, multiplication of instruments and facilities with no increase in efficiency, and frittering away time and energy on work properly belonging elsewhere, were given with a convincing emphasis, which made it a little difficult, at the close of the address, to believe that there were two sides to the question.

With the assembling of congress, the committee appointed by that body to report upon the advisability of a union of the scientific bureaus of the government has taken up its work again. Two or three meetings have been held, at which one or more officers of the signal corps have been examined. Most of the evidence obtained by this committee prior to the current session has been widely published, and read by many with much interest. It may be inferred, from the promptness with which the committee has begun the collection of testimony at the opening of the session, that it is desirous of making its report at an early day: indeed, it is generally thought that not much more will be done in the way of examination of witnesses.

The signal service, which has received much attention during the past year at the hands of this committee, as well as from the general public, is preparing for the introduction of one or two im-

portant changes in its observation work about the first of January. The most notable is the introduction at the most important stations, and as rapidly as possible throughout the whole service, of the whirling psychrometer instead of the still wet and dry bulb now in use. An entirely new set of hygrometric tables has been computed for the reduction of observations made by the new method, a suitable whirling-machine has been devised and adopted, and machines for station use are now being constructed. It is also understood that the service has determined to use for this instrument thermometers with cylindrical bulbs, instead of the spherical bulbs at present used, on account of the greater sensitiveness of the former. The introduction of these improvements constitutes a decided advance in the hygrometric methods of the service. Z.

Washington, D.C., Dec. 14.

LONDON LETTER.

At the election of the council and officers of the Royal society, which took place on St. Andrew's day, Prof. G. G. Stokes, the senior secretary of the society, was unanimously chosen as Professor Huxley's successor. He graduated at Cambridge in 1841 as senior wrangler and first Smith's prizeman, and was elected to his present office, the Lucasian professorship of mathematics, eight years afterwards. He was elected into the Royal society in 1851, and became its secretary in 1854. Professor Stokes's successor as secretary to the Royal society is Lord Rayleigh.

The award of one of the royal medals to Prof. E. Ray Lankester by the council of the Royal society will meet with the warm approval of all English biologists, and is a fitting recognition of his many contributions to zoölogical science, which range over a great variety of subjects, the earliest of them being now some twenty years old. Professor Lankester was for some years the only representative at Oxford of the modern school of zoölogy, and since his appointment to the zoölogical chair at University college he has trained several students of the greatest promise. He is also well known as the editor of the *Quarterly journal of microscopical science*, which, owing in great measure to his influence, has risen from being an organ of almost pure microscopy to the position of a first-class zoölogical journal. It is a good sign of the activity of the young biologists who are now being turned out from the universities of Oxford and Cambridge, London and Manchester, that the supply of contributions during this year has been more than sufficient for the regular quarterly issue of the journal. A supplemental number was published in July, and the first part of a new volume has just appeared, bringing up the total issue for the whole year to six parts instead of four, as has hitherto been the rule. The journal will in future appear at irregular intervals, just as the German zoölogical serials do, according to the amount of material in the editor's hands.

The 30th of November (St. Andrew's day), which closed Professor Huxley's term of office as president of the Royal society, has witnessed the retirement of Sir Joseph Dalton Hooker, a former occupant of the presidential chair, from the directorship of the Royal gardens, Kew. He was appointed assistant director in 1855, and succeeded to his present office ten years later, on the death of his father, the late Sir William Hooker. His administrative work has been well described as "performed in such wise as to win, along with national applause, the gratitude of the scientific world." It may almost be considered as certain that the vacancy will be filled by the promotion of his son-in-law, Prof. W. T. Thisleton Dyer, who is the present assistant director, and has been largely instrumental in bringing about the revolution in botanical teaching which has taken place in this country of late years.

As in the case of Professor Huxley, Sir Joseph Hooker's retirement from the routine of official duties will enable him to devote more time to purely scientific work than he has hitherto been able to give; and he will therefore be able to hasten the completion of his great monograph on the flora of British India.

At a recent lecture on the electric telegraph, delivered to the members of the Birkbeck institute, in London, by William Lant Carpenter, the following figures were given on the authority of the British general post-office, to indicate the increase of the use of the telegraph since the adoption of the 'twelve words for sixpence' (address included) rate: The total present mileage is 156,000 miles, and the number of instruments employed is 17,100, of which 26,000 miles and 900 instruments are due to the increase. In the week ending Nov. 14, 1885, 895,781 messages were sent, showing an increase of 40.3 per cent over the corresponding week of 1884. In London, however, the increase is 60 per cent; and in that city alone the 'registered addresses' have increased from 2,000 to 9,000. The average price of messages is 8d., as compared with 13d. under the old tariff. When the lines were purchased by the government in 1870, the average number of messages weekly was only 126,000, and the press messages, then barely 5,000 words per day, now exceed 1,000,000.

The electric lighting industry in England has been, as is generally known, almost throttled in its

infancy by legislative restrictions. Under the rules of the electric lighting act of 1882, no commercial company could light a district successfully, in a financial sense. In the new parliament, this, among other matters, calls for urgent notice and remedy. Meantime the Anglo-American Brush corporation is endeavoring to induce small groups of house-holders, four, six, or more, to unite in a joint local installation, at an initial cost of about $500 for an average-sized house. The plant proposed for such a group is either a steam or gas engine, dynamo, and secondary batteries, whose great use in domestic lighting has been repeatedly demonstrated by Mr. Preece, Mr. Swan, and many others interested in the matter.

At the recent opening of the session of the Society of arts, the president, Sir Frederick Abel, F.R.S., directed attention to machinery and appliances used in mines, and, contrary to general expectation, showed that explosions were not the greatest cause of loss of life in coal-mines. In the ten years 1875–1884, out of 11,165 deaths from accidents of all kinds in coal-mines, only 2,562, or roughly one-fourth, were due to fire-damp explosions; the remainder being caused in about equal shares by, 1°, falling in of roof and sides, and, 2°, other causes. The address, which is replete with interest, and can be read in full in the journal of the society for Nov. 20, concludes with some strong comments upon the part taken by the *Times* in regard to the delay in the report of the royal commission (of which the speaker was a member) upon the whole subject.

Two other presidential addresses lately delivered need a word of notice. The Marquis of Lorne (late governor-general of Canada), the president of the Royal geographical society, referred in some detail to the discoveries made in the basin of the river Kongo, in Africa, by Rev. G. Grenfell (a Baptist missionary) and Lieutenant Wissmann, as well as by Portuguese travellers. He then called attention to the recent endeavors of the society to improve geographical education in English schools and colleges, and to the exhibition, shortly to be held, of appliances and methods of teaching it, collected by the society's special commissioner, Mr. J. S. Keltie, in a recent continental tour.

During November a meeting was held in London to celebrate the granting of a royal charter to the Institute of chemistry, a body which has been at work for some years, with the avowed object of raising the status of analytical chemists, and doing for them what the College of surgeons, the old guilds, and the modern trades-unions, do for their respective professions and trades. An address was delivered on the occasion by Professor Odling, the president, who holds the chemical chair in the University of Oxford. He began with a history of the movement, and the increasing need of 'professional services,' and then considered the position of 'experts' as witnesses in the law-courts. The part of his address, however, most criticised, is that in which he dealt with the vexed question of the endowment of research and the pursuit of research, on the one hand, for its own sake alone; on the other, for the pecuniary rewards which are sometimes the result of it. *Nature* concludes a long article upon it in the words, "We wish it to be known, therefore, that the spirit it (Professor Odling's address) breathes is an alien spirit, repugnant to students of pure science in this country." W.

London, Dec. 1.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Newcomb's 'Political economy.'

MR. JAMES has quite misunderstood my remark about bimetallism. I admitted that the word *assume* did not correctly convey Professor Newcomb's idea; and I thought I sufficiently indicated that Professor Newcomb's sole intention, in the passage in question, evidently was to tell the student what was *meant* by a system of unlimited bimetallism. In other words, his sentence (which I admitted was unfortunately worded) was simply meant to state that the government *chose* a fixed ratio of values in their system of coinage. Newcomb says nothing at this point in the way of discussion; in a later part of the work he devotes a considerable amount of space to an examination of the arguments on both sides, and does not find that we can positively declare either that the bimetallists are wrong, or that they are right. Under these circumstances, I leave it to the reader to decide whether Professor James has dealt fairly with his author in insinuating that he caricatured the views of bimetallists.

As to the rest of Professor James's reply, I shall permit myself only one remark. He, in common with many of his school, seems to identify English political economy with *laissez-faire*, and persistently confuses the question of scientific method with that of practical conclusions. This is illustrated by what he says about Sidgwick. He does not deny — what is obvious to every reader, and what Sidgwick expressly asserts — that Sidgwick's method is essentially that of the earlier English economists; and this was the only relevant question. Of course, Sidgwick's book shows marks of his indebtedness to German writers, when he explicitly acknowledges (as I mentioned) his special obligations to Held and Wagner; but this does not in the least modify the fact that his method of investigation (or 'style of reasoning,' to quote Professor James) is quite unaffected by these writers; and this was the only point at issue. But with a writer who sees no distinction between an adherence to the methods of Mill (which was what I spoke of) and an adherence to his 'methods and system' (whatever that may be), it is hardly profitable to carry on a controversy. FABIAN FRANKLIN.

Baltimore, Dec. 11.

A national university.

The strictures in *Science* (vi. 509) upon the recommendation of Secretary Lamar that a national university be established in Washington, seem to me to be based upon a narrow view of the subject, and to be easily answered. The fact that the project has been opposed by the able president of one of the leading endowed colleges, who would be least disposed to look with favor upon any rival institution, cannot justly be urged as an argument against it, and that a senate committee should have been found indifferent to it in 1872 has no bearing on its merits.

The claim that there is "a fatal defect in any congressional bill to establish a university, so long as the principles of appointment to United States offices, and the tenure of those offices, remain what they now are," cannot be sustained in the face of the excellent and permanent scientific bureaus that have latterly grown up under the government, and to which the secretary refers. The officers of these bureaus have been selected with special reference to their fitness, as is proved by the results; and they have almost, without exception, held office continuously through several administrations, including the recent reversal of parties. No such narrow policy as that of territorial representation has governed these appointments, the government having exercised its right to select from the entire country, and secure the best talent.

But permanent tenure of office is by no means secured in private institutions. Even the highest undergo changes without detriment. Examples here would be superfluous. The government should surely have the same right that these have to improve the quality of its staff of officers. This objection, therefore, seems purely imaginary.

The territorial distribution of scholarships, on the other hand, ought to have nothing objectionable about it. It strikes me as altogether proper. The few students that can at best be instructed in any one institution, however large, are but a small fraction of the number who desire and will receive advanced instruction in the whole country; and it seems right that these few should, as nearly as practicable, represent the whole country territorially. Neither does there seem any inherent evil in permitting the national representatives to control this trifling patronage.

But a true university is not a mere school for the training of great numbers of young people. It is an institution in which the most perfect appliances for original research may be brought together, and where a few who are able and willing to avail themselves of them may have an opportunity to do so. The tenor of the secretary's report clearly shows that this is what he contemplated by a national university. He regards the existing scientific bureaus of the government, with all their apparatus and appliances, as the 'foundation' upon which to erect a university as a 'superstructure,' thus making it a positive aid to the necessary research that the government must carry on. The whole would thus become a great American institute, analogous in some respects to the Institute of France.

Finally, the assumption that the establishment of such an institution would 'be acting on un-American principles,' is, I think, also untenable. It would seem at the outset that a project that found favor in the eyes of 'Washington, Adams, Jefferson, and Madison,' could scarcely be regarded as 'un-American.' Is it, then, implied that schemes of public instruction are generally un-American? Certainly no other country in the world possesses any such system of public schools as the United States, and perhaps no American institution is more popular than our educational system. Whether sound or unsound, popular or state education is at least a thoroughly American idea, and the tendency is constantly to extend it to the higher branches of learning; as, witness the 'grammar schools' of most cities, and the numerous state universities. It is true that this work is chiefly conducted by states and municipalities, as the natural way under a government constituted as ours is; but for a long time there has also existed a national 'bureau of education' at the seat of government, designed to aid and advise, rather than to control the entire system.

Neither can it be considered un-American for the government to encourage and actively prosecute scientific researches. No government in the world is doing so much in this line to-day as the United States, and *Science* stands in an excellent position to know the extent and quality of our government scientific work as well as the practical results which it is producing. In this respect we are becoming the envy of European nations, and they are just now beginning to learn from us that it is sound national policy.

A national university or institute of the kind intimated in Secretary Lamar's report would be thoroughly American in its conception and aims, and would fittingly crown the educational system of the country. Its organization should, and probably would, be largely intrusted to the National academy of sciences, whose advice in scientific matters the government is legally entitled to ask. On the contrary, the objections raised in *Science* seem to reflect the views of a now waning English school of economists, who continually cry 'let alone' to every thing the government undertakes. LESTER F. WARD.

[When a young man enters the service of any of our half-dozen leading colleges, he does so with the knowledge, that, as soon as he has proved himself a valuable member of the body of teachers, he will be given a position with a tenure of office through good behavior, and with a fair salary considering this permanency. In any university established by congress, not only would permanence of tenure be out of the question, but the efficiency will be affected and the very life of the institution threatened each year by the vacillating policy which any legislative body will necessarily pursue with regard to the sustaining appropriations. Whenever this country is ready for an American 'institute,' it will probably be an outgrowth of the National academy, the value of which is as yet not appreciated. Let us go slowly. It must be remembered that the principal advocates of the importance of governmental guidance of human affairs are residents of a country in which no other initiative force has been known. — ED.]

Crystals in maple sirup.

I was surprised on reading in your issue of Dec. 11 the note from Mr. J. H. Sears, in which he speaks of crystals formed in maple sirup being noticed for the first time. I had supposed it to be a very common occurrence. So far as my observation has gone,

unless the sirup be put into the cans in a very watery condition, the formation of a thick layer of crystals at the bottom invariably follows; and I have often seen great difficulty experienced in removing it without breaking the cans. J. EDWARD CHAPPEL.

Warsaw, N.Y., Dec. 14.

International geological congress at Berlin.

On referring to the original notes which I took during the sessions of the International geological congress, I find that Mr. Archibald Geikie moved to strike out all the words after 'Coudroz' except 'l'Old Red,' in the paragraph (l. c., p. 15) of the report of the committee on uniformity of nomenclature, my account of which Dr. Dewalque criticises in *Science*, Dec. 11. Upon this, M. Renevier asked, 'on principle,' that the whole paragraph be struck out, on the ground that the congress ought not to go into such details. There is no mention in my rough notes that this was done; but in the fair copy, which I submitted to some of the leading members of the congress for their approval or correction, I find a pencil note to the effect that M. Renevier's motion was carried. I cannot recall the authority for this note, which was embodied in the short summary which, with the assistance of Professor Williams, I prepared for *Science*. I should like to state here, that in spite of the employment of the greatest possible care, and the assurances of the accuracy of the account of the meeting, which is about to appear in the *American journal of science and arts*, from some of the most active participants in the discussions, some errors, though I trust none of importance, will probably be found. To those who are aware of the exceedingly inferior acoustic qualities of the hall, and the involved nature of some of the discussions and votes, these will be thought pardonable. PERSIFOR FRAZER.

Philadelphia, Dec. 12.

Earthquake-shocks more violent on the surface than in mines.

It has been sometimes observed that earthquake-shocks are felt more severely in mines than at the surface. This may be accounted for partly by the rapid decrease of the shock-motion (wave-height) which is supposed to vary inversely as the square of the distance from the focus or radius of the agitated sphere, partly by the quenching of the earth-wave by repeated reflections in passing through media of different elasticities, and by the fracturing of the imperfectly coherent media through which it passes. But the converse phenomenon, viz., the greater severity of shocks on the surface than in mines, is, I believe, far more common. This was very conspicuous in the Inyo earthquake of 1872; for buildings were shattered and the earth was broken in many places, and yet persons working in the mines were scarcely aware of any movement. The same has often been observed in Peru.

There are two ways in which I imagine this may be explained. The more obvious is as follows: As long as the earth-wave is within the earth, the back-and-forth movement (shock-movement) is largely restrained by the work of elastic compression of the earth in front necessary for the progress of the wave. But as soon as it reaches the surface the motion is free or unresisted, and therefore much more rapid, — so rapid as often to break up the surface, and throw loose lying bodies high into the air. But there is another explanation which is perhaps more doubtful, and which, therefore, I offer with some hesitation as a mere suggestion, in the hope that some one may be able either to follow it up or else to disprove it.

In the *Philosophical magazine* of June, 1849, p. 404, the royal astronomer, Professor Airy, drew attention to the peculiar phenomena of what he calls broken waves, or broken-headed waves. These are retarded, discontinuous waves; in other words, breakers. If a normal wave strike against a sea-wall, it will of course be reflected; but if a breaker, a broken or broken-headed wave, thus strike, the swell or unbroken part is reflected as usual, but the broken part is not. If it strike perpendicularly, the broken part is thrown up and destroyed. If it strike at small angle, then the broken part runs along as a strong wave clinging to the surface of the wall. I have myself observed this behavior of broken waves.

Professor Airy then applies this principle to the explanation of certain phenomena of whispering-galleries. The voice produces normal waves; but a hiss, a buzz, and therefore a whisper, produce broken, discontinuous waves. Now, in these galleries the voice is reflected in the ordinary way; but a whisper runs along, clinging to the surface of the wall and dome, and may be heard, if the ear be applied to the wall, at much greater distance than the much louder voice.

Now, may not this principle be applied also to earthquake-waves? 1°. The surface of the earth must be regarded as a very perfect reflection for waves emerging from below; as much so, in fact, as for sound-waves entering the earth from the air. Therefore normal waves emerging on the surface must be largely reflected back into the earth again. 2°. But earthquakes are pre-eminently broken, retarded, discontinuous waves. Passing, as they do, through an imperfectly elastic and slightly coherent medium, which is fissured and crushed at every step of its progress, the normal continuity of the waves is destroyed, and the waves retarded and their energy dissipated, by change into other forms of force, especially heat. For this reason the velocity of heavy earthquake-waves is always much less than that of normal elastic waves in the same medium. For this reason, too, they are rapidly quenched, and therefore extend much less distance than they otherwise would. 3°. If, then, we assume that earthquake-waves are broken and retarded waves, they ought to follow the law pointed out by Professor Airy. When they strike full on the surface, as at the epicentrum, they simply destroy themselves by the work of breaking the surface, and are not reflected. When they strike at small angle, as at a distance from epicentrum, they must run along as a strong wave clinging to the surface. JOSEPH LE CONTE.

Berkeley, Cal., Dec. 5.

An unreliable treatise on disinfectants.

That 'unreliable treatise on disinfectants' criticised by you Dec. 4, deserves even less mercy than you have shown it. When the publisher declares that there is no indorsement of the essays as scientific, and the one selected as the best is chosen as a standard of the excellence of the work as a whole, all persons in the least familiar with the present position of sanitary science must wonder why the

volume ever saw the light. Mr. Benjamin's article was singled out by Messrs. Lattimore and Remington as worthy of the first prize, probably because of the following 'practical and otherwise valuable' information which it contains: "All that is required to immediately purify and sweeten a contaminated air-supply, however originated, is to dip a cloth in the liquid (a solution of nitrate of lead and common salt), and hang it up in the apartment." Or perhaps they thought sulphate of iron, charcoal, and table salt were of much greater value than chlorinated lime, mercuric chloride, or mercuric iodide. Their fathers thought so, and therefore the new-fangled notions of bacteriologists must be disregarded as unscientific and impractical. They believed that Dr. Baker's special training as a physician, and his experience as founder of the state board of health of Michigan, as well as member of the committee on disinfectants of the National board of health, unfitted him as a judge of such matters. In spite of his earnest protests, they insisted upon giving the first prize to a paper which he declared was unworthy any prize. Their special training as analytical and pharmaceutical chemists fitted them for just such work, because they knew nothing of Pasteur or Magnin, Koch or Miguel, Sternberg or Klein, other than they happened to see in the *Rochester post* or *Philadelphia ledger*.

G.

Brooklyn, Dec. 11.

The English sparrow.

The despised sparrow is entitled to a good word if he can secure it. He has come to stay, and no amount of vituperation will displace him. 'He is too many,' and has spread over too large a portion of the union. The sparrows crossed the Mississippi River at Clinton, Io., about 1875, and have increased largely. They confine themselves principally to the railroad buildings and some of the business blocks, though they occasionally nest on private houses.

When this town was founded, twenty-five years ago, there were no trees or shrubbery near, and consequently few birds. Now the town looks like a forest in the distance. The consequence is that robins, thrushes, orioles, blackbirds, bluebirds, and many other birds, are very numerous, and seem to be increasing. Numbers of blue jays nest in the shade-trees, and stay with us during winter. The sparrows have never seemed to drive any away, as each year more nests of summer birds have been observed. They confine themselves to the open spaces and streets, and do not nest or frequent the trees or shrubbery. They have never been observed in the fields outside of town, and do no injury to fruit or seeds in gardens. They live largely on insects, as has been shown by examining their crops. In winter they are mainly dependent on the seeds and grains they can pick up. They fall victims to the jays and the butcher birds, but a crowd of them makes a good fight against the aggressors. There are millions of them in every large town, on the railroads of this state, and there is no way of exterminating them, and no wish to on the part of unprejudiced people. There is no law for their protection in this state, only a general friendliness toward them as toward all small birds.

P. J. FARNSWORTH.

Clinton, Io., Dec. 10.

It must be admitted that the English house-sparrow will eat seeds and fruit, but it should be remembered that the young sparrows are fed chiefly on insects and caterpillars; and a good English authority (Yarrell) observes that "so great is the number of these consumed by the parent birds and their successive broods of young, that it is a question whether the benefit thus performed is not an equivalent even for the grain and seeds eaten by the adult birds at other seasons of the year."

Dr. Elliott Coues, in his notes to Stearns' 'New England birds,' advocates the extermination of the English sparrow, and calls it 'the parasite.' This is not a translation of its scientific name, Passer domesticus, and does not accord with any known habit of the birds in question. Dr. Coues has no fault to find with a native tree-sparrow (Spizella monticola), which he says exists in large quantities, and feeds only on grain and seeds. All specimens shot by Dr. Coues had their crops full of seeds.

The sparrows which damage the crops and orchards in England are another species, called the field-sparrow. I have seen these in flocks of over a thousand rise at one time from a field of grain. This is, I presume, the bird described by Dr. Coues as Passer montanus. He states they are now found in New England, but I never heard of their having been imported.

I rather doubt the stories about the English sparrows molesting the bluebirds at breeding time. It is well known that most birds are very pugnacious at this period, and I am personally acquainted with the fact that bluebirds are particularly courageous at this season. On one occasion a bluebird made its nest in my garden, in the hollow of a tree, about six feet from the ground. One day, when busy inspecting the nest, I received a violent blow on the side of the head, and, on looking up, saw the parent bluebird flying away. I found that whenever I placed my hand in the nest, I was attacked in this manner. I apprehend, that, if a bluebird will attack a man in defence of its nest, it is not likely that a sparrow would do so with impunity.

I notice that Dr. Bechstein, in his standard work on birds, published as one of Bohn's library, states, that although the house-sparrow has no song, he can be educated to sing equal to the canary. I was also surprised to find in the same work (p. 249) that the house-sparrow could be taught to speak: it mentions a clergyman of Paris who had two of these birds which could repeat the fourth, fifth, sixth, and seventh commandments. It is gravely stated that when these birds quarrelled over their food, "one of them would admonish the other with the remark, 'Tu ne voleras pas.'"

Giving due credit to the house-sparrow for all his accomplishments, I fear he can speak the French language only in fable.

JOHN MICHELS.

New York, Dec. 10.

The temperature of the moon.

Now that the temperature of the moon has become a subject of investigation with the aid of recent refinements in the methods of observing very small intensities of heat radiation, it may be well to also look at the matter from another stand-point.

The condition which determines the static mean temperature of the whole mass of the moon is, that its rate of losing heat by radiation from its surface shall be exactly equal to the rate with which it receives and absorbs the heat radiated from the sun,

in comparison with which the heat coming from the stars, and that radiated and reflected by the earth, may be neglected without any sensible error. But by the generally recognized principle that the relative radiating and absorbing powers of bodies are equal, the ratio between radiation and absorption is the same for all bodies at a given temperature; so that it is not necessary to consider the radiating power of the moon, but to simply satisfy the condition that the moon, with a surface of maximum radiating power, such as a lampblack surface, shall radiate heat as fast as it is received from the sun.

All bodies are so constituted that their absolute radiating power is a function of the temperature, the former increasing with the latter, but by no means in proportion. If, therefore, we know the relation between the temperature of a body and its rate of radiating heat, and also know the rate with which it is receiving heat from its surroundings, we can, by means of the preceding condition, form an equation of condition which determines the temperature.

According to Pouillet's determination from the experiments of Dulong and Petit, a square centimetre of surface of maximum radiating power, and at the temperature of 0° C., radiates 1.146 calories of heat per minute; and hence, by the law of Dulong and Petit, the rate of radiating heat for any other temperature θ, is $1.146\mu^\theta$, in which $\mu = 1.0077$. The rate with which a square centimetre of surface normal to the direction of the sun's rays receives heat from the sun is what is called *the solar constant*, usually denoted by A. Putting, therefore, s for the area of the moon's surface in square centimetres, and a for that of a great circle, the rate with which heat is radiated from the moon's surface is expressed by $1.146\,\mu^\theta s$, and the rate with which it is received from the sun, by Aa. Hence, by the conditions above, since $s = 4a$, we get in the case of the moon in space, in which it loses heat by radiation only, and receives it from the sun only, the equation

$$\mu^\theta = \frac{A}{4.584}$$

for determining θ where A is known. Since $\log \mu$ is exactly equal to 1-300, this may be put into the following convenient and practical form:—

$$\theta = 300 \log \frac{A}{4.584} = 300 (\log A - 0.6612).$$

From this equation, deduced as a simple case from a more general and mathematical treatment of the subject in the 'Temperature of the atmosphere and earth's surface,'[1] the writer, with the assumed value of $A = 2.2$, deduced the value of $\theta = -96°$ C. But as there is some uncertainty with regard to the value of this constant, since some of the solar rays may be entirely absorbed before reaching the earth's surface, and it is thought by some to be considerably greater than this, we shall put it here equal to 2.5. With this value we get $\theta = -79°$. This must be understood to be the mean surface temperature of the moon, or, more accurately, the temperature of a surface uniformly heated which would radiate as much heat as the surface of the moon, which, of course, has very different temperatures on opposite sides at any given time.

The law of Dulong and Petit being an empirical one, which satisfied the experiments from 0° to 300° only, there is some uncertainty in extending it down to $-79°$; but this is very small in comparison with what it is in extending it in the other direction, up to the temperature of the sun, as has been done by Pouillet and others, in forming an equation for determining its temperature. The uncertainty in the true value of A, together with that in the extension of the law down to so low a temperature, causes some uncertainty in the mean temperature of the moon as thus determined; but this is not very great in a matter of this sort, for it amounts to only 17° in an uncertainty of one-eighth part in the value of A.

But when we attempt to determine the temperature of the side of the full moon exposed to the sun and earth, the uncertainty becomes very much greater. In this case the heat is not only radiated from the surface, but it is also conducted inward from the surface heated far above the mean temperature of the moon, and stored away for the time. The rate with which it is conducted in depends upon the conductivity and capacity of the lunar soil for heat, which are unknown to us; and the problem would be extremely complex if they were known. The temperature of the moon's surface, in this case, can only be determined for the two extreme hypotheses of infinitely great and infinitely small conductivities for heat. Upon the first hypothesis, the heat received and absorbed by the moon would be instantly distributed through the whole mass, and radiated equally by all parts of the moon's surface, and the temperature of the part exposed to the sun's rays would be the mean temperature of the moon as obtained above. Upon the other hypothesis, it would not be conducted away at all from the surface receiving it, but, in case of a static temperature, it would all have to be radiated away by the same surface receiving it. Hence, in this case, instead of the radiating surface being four times as great as the surface, or normal sectional area receiving it, it is only equal to it for the part of the moon's surface upon which the sun's rays fall perpendicularly, and we must therefore have $1.146\mu^\theta = A$, or

$$\theta = 300 \log \frac{A}{1.146} = 300 (\log A - 0.0592),$$

instead of the preceding similar expression.

With the assumed value of $A = 2.5$, this gives $\theta = 101°$ for the temperature of the central part of the moon's disk as viewed from the sun, and from the earth at full moon. For other parts, the value of A in the preceding expression must be multiplied into the cosine of the angle of incidence of the sun's rays upon the moon's surface, and thus this expression will give the temperature down as low as it is safe to extend Dulong and Petit's law. The same results would be obtained sensibly with any ordinary conductivity for heat if the same side of the moon were permanently exposed to the sun, for the temperature gradient by which the heat would be conducted inward would soon become so small, in this case, that the rate by which heat would be conducted inward would be insensible, as in the case in which heat is conducted outward from the interior of the earth.

The result above, of 101°, which is a little above the temperature of boiling water, must be regarded simply as a limit beyond which, in a large range of uncertainty, the temperature cannot go. The other limit is $-79°$. If we suppose the temperature of the warmest part of the moon's disk to fall halfway between these extremes, it would be a very little above a freezing temperature. WILLIAM FERREL.

[1] Professional papers of the signal service, No. xiii.

Recent Proceedings of Societies.

Academy of natural sciences, Philadelphia.

Dec. 1. — Prof. Thomas Meehan referred to an ear of corn, exhibited last year, on which some of the grains were of a rich red color, while others were creamy white. The specimen had been sent to him as probably illustrating the occurrence of hybridity, and his assertion to the contrary had been disputed on the ground that the impossibility of cross-fertilization had not been proven. He now had the opportunity of exhibiting an instance of change of color in the seeds of the honey-locust from the normal dark tint to a light gray or whitish hue. As there is but one species of the plant in this region, the idea of hybridity is, of course, excluded, the change of color probably depending on an innate power to vary, entirely independent of cross fertilization. The variation will probably have the power of perpetuating itself, as there is no evidence that the change of color in the seeds is the effect of disease. —— Dr. Koenig reported having determined the presence of three species of diatoms in the blue clay of the railway cutting at Gray's Ferry road. These were Pinnularia viridis, P. inaequalis, and a probably undescribed form. The greater bulk of the bed was found to be composed of soluble silica, which may at some time in the future have a commercial value. He believed the bed, which is of fresh-water origin, to be of the same age as in the Richmond clay, and other diatomaceous tertiary deposits. —— Professor Heilprin called attention to the fact that in consequence of the persistence of many species of diatoms in successive geological formations, it is difficult to determine the age of a deposit by the presence of these organisms alone. He also stated that in a fossiliferous pebble collected by Mr. Woolman near Tacony, he had been able to determine the presence of two species of trilobites, and two of brachiopods, together with impressions of crinoids and cephalopods. The fossils were all of Devonian age, and had been transported from the region of the Delaware Water Gap by glacial action.

Anthropological society, Washington.

Dec. 1.— Dr. Miles Rock, who is engaged in surveying the boundary between Guatemala and Mexico, gave an account of some ruins, hitherto unknown, which he had recently visited. These ruins are in a basin of the Lagartero River, a tributary of the Chiapas. The country has evidently been thickly populated, and many remains of villages and towns are found. What is remarkable is the absolute denudation of the portions formerly tilled, leaving a surface of barren rock. The process of denudation was apparently going on before the abandonment of the country, as efforts to check it are visible in existing walls and terraces, which still retain small tillable patches. The ruins consist largely of stone floors raised above the ground, and which may have formed the basis for superstructures of less permanent material. In Dr. Rock's opinion, these remains are more ancient than the better-known ruins of Central America and Yucatan.

Society of natural sciences, Buffalo.

Nov. 13. — D. A. Kellicott gave in detail some facts in the life histories of a wood-boring larva, Harmonica pini, — an Aegerian enemy of the native pines, boring in the trunks, and causing large exudations of pitch, under which the larva passes its larval and pupal life. Mr. Kellicott believed the larval period was probably of three years' duration, from the fact that early in July, 1883, at the time the moths were escaping, fully formed pitch excrescences containing larvae of one year were marked, from which, in July, 1885, moths escaped. —— Dr. J. Pohlman discussed the geological history of Grand Island. He said that the valley of the Tonawanda was of preglacial origin, as is demonstrated by its surface deposits of glacial drift. In its area we can conveniently include all that tract of land between the watershed of the Genesee River on the east, and the Grand River of Canada on the west; the ridge of Niagara limestone on the north, and the corniferous limestone terrace on the south; which latter we can trace along upper Main Street and Humboldt Parkway, towards the frontier, into Canada. According to the treaty of Great Britain, the line of deepest water was accepted as the boundary between Canada and the United States, and thus Grand Island became a part of the latter. Geological evidence rather tends to prove the wisdom of this decision, because it demonstrates that Grand Island was a peninsula projecting from the American side within a recent period, geologically speaking: in fact, it would be a peninsula to-day, if the waters of the river subsided only twelve feet. The soundings given on the map of the lake survey demonstrate this conclusively. We find that the river between Black Rock and Tonawanda has an average depth of about thirty feet, while to the north of the latter place it shallows suddenly to fourteen and fifteen feet; and all along that part which runs north of Grand Island its depth exceeds twelve feet in only a few isolated spots. The western branch of the river has a more or less uniform depth of twenty-five to thirty feet. The only exception to this we find at the southern end of Grand and around Strawberry Island, where the river apparently deposits its largest amount of sediments, and where the waters are somewhat shallower. Now, the question occurs, How was Grand Island formed? In preglacial times the water of the Tonawanda valley, after following a more or less meandering course in the soft shale and gypsum layers of the Onondaga salt group which formed their bed, ran into the present Niagara at or near Tonawanda village; then it took a southerly course until it encountered the hard corniferous limestone ridge at Black Rock; from here it ran north again along the western branch of the present river, and then found its way along the Niagara gorge and the St. Davis valley, into Lake Ontario. This left Grand Island a peninsula, or, better, a large bend in the ancient river. Of course, nobody can tell at what period in the geological history this took place: we only know that it happened before the advent of the ice period, which worked such important changes in the physical geography of this section of America. During glacial times all the river-valleys became filled with a deposit of clays, gravels, and sands; and on the return of a temperate climate, Buffalo and the surrounding country was covered by water to the height of at least 1,000 feet, as demonstrated by beaches found in Canada 1,500 to 1,600 feet above the ocean. We need not follow the slow subsidence of the waters, but begin our observations again when Lakes Erie and Ontario stood at the same level

at the height of Lewiston ridge, about thirty feet higher than our lake-level to-day. Then the waters flowed in a broad sheet over the mud-flat that separated the two lakes. And as this outflowing water gradually cut down into the old river-beds as the lakes subsided, the top of the clay deposit that covered the ancient peninsula appeared above the surface of the water as the earliest portion of what is now known to us as Grand Island; and as the outlet into Lake Ontario lowered, the island grew larger with the increasing depth and the narrowing of the channels on either side. But long before the island had attained any dimensions, the waters of the eastern branch of the present river had to force an outlet through the clay deposit between Tonawanda and the head of the rapids; and this outlet, deepening with the subsidence of the waters, cut off the area of Grand Island from the mainland; and the proof of this we find in the sudden decrease of the depth of the river from Tonawanda northward. —— Professor Kellicott called attention to a modification of the usual pipette. The glass tube passed completely through the ball, the end of the tube being closed with a cork, or hermetically sealed; holes for suction being drilled through that portion of the tube enclosed within the ball. The advantages of this contrivance lie in the increased firmness in handling the pipette, and consequently greater suction-power.

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SCIENCE.—SUPPLEMENT.

FRIDAY, DECEMBER 18, 1885.

THE MIND-CURE.

THE attraction of the mysterious is proverbial; and, as no satisfactory explanation has yet been offered for the series of phenomena which are included in the term 'mind-cure,' it is not surprising that the general interest in it keeps alive. The facts are both too old and too new to be ignored. From the time when Moses lifted up the brazen serpent in the wilderness, and assured those who had been bitten by the desert scorpions that if they looked fixedly at it they would recover, down to the present day, when the faithful Catholics visit Lourdes in crowds, religious, psychological, and medical records have contained 'authentic' accounts of mind-cures. The facts have been heralded under different names, — 'miracles,' 'mesmerism,' 'animal magnetism,' 'spiritualism,' 'expectant attention,' the 'faith-cure.' They have always aroused attention, they have given rise to many theories and endless disputes, and they have baffled explanation. The last attempt to solve the problem[1] is no more satisfactory than others. What are the phenomena with which it tries to deal?

If you fix your mind upon one of your fingers, and look at it steadily for five minutes, you will become conscious of sensations in that finger which were previously unnoticed. If the finger happens to be cut, the pain will become more acute, and it may begin to bleed. If it does bleed, and you feel alarmed, you will breathe more rapidly, your heart may palpitate, and your face will turn pale: you may even faint away. This is a simple series of phenomena which illustrate the interactions of mind and body. If you happen to have overeaten, and in consequence begin to suffer from indigestion, you will notice not only a physical discomfort in the stomach, but also an indisposition to mental effort, an undue weariness on slight emotion, a growing inclination to look upon the dark side of things, and, if the dyspepsia becomes chronic, a decided persuasion that your financial affairs are becoming involved. Niemeyer relates a story of a very wealthy man whom he treated for chronic catarrh of the stomach. During the disease he thought he was near bankruptcy, and left unfinished a building that he had begun, because he thought he had not sufficient money to continue it. After spending four weeks at Carlsbad, his old strength and feelings returned, and he finished his house with great splendor. Probably there is no one who cannot recollect some instance equally striking of an influence of bodily condition upon mental action.

[1] *Mind-cure on a material basis.* By SARAH E. TITCOMB. Boston, *Cupples, Upham, & Co.*, 1885. 8°.

The facts of central localization of late established, have been thought to bear somewhat upon this subject. Every portion of the body sends in a set of nerve-threads to a corresponding portion of the brain, so that an imaginary map of the organs and surface can be pictured upon the surface of the cerebral hemispheres. The changes in any organ are therefore communicated to the part of the brain which presides over the organ; and, conversely, changes in that part of the brain may be communicated in turn to the organ. If we accept the theory that when the attention is directed to an organ its part of the brain is thrown into activity and becomes highly receptive and highly potential, we have simply advanced from one set of facts to another without at all touching the problem of how the interaction is brought about.

There are certain affections, however, which can be explained satisfactorily only on the theory that the disease lies, not in the organ which is supposed to be affected, but in the part of the brain which corresponds to it. If my finger is receiving impressions of heat or cold which pass unnoticed until I think of the finger, it is conceivable that my attention might be held so closely to some startling sight, that even a severe and painful impression in the finger might be unheeded in my interest in the terrible spectacle. Soldiers in battle have been known to go on fighting, though wounded, without perceiving their wound. Here a true mental loss of sensation has been present. Conversely, I may be in such a state of expectation regarding an organ, that a slight sensation in that organ may be misinterpreted and exaggerated till it corresponds with the expected feeling. At night, in the dark, how our youthful fears have been excited by a slight noise in the room! The story goes, that a French convicted criminal was told that he was to be bled to death; and when his eyes had been bandaged, and his arm touched with a cold iron, drops of water were allowed to fall into a basin at his side, where he could hear them. He gradually became more and more pallid, and at

last it was impossible to resuscitate him, though not a drop of his blood had flowed. Here the mental sensation was so intensified by attention and expectation, that general bodily effects of a fatal character ensued. The experiments of Mesmer and Braid are familiar to the older generation. To the younger the miracles of Lourdes are equally well known. They all correspond to the facts already cited, and simply increase the weight of evidence in favor of the proposition that mind and body interact.

The question will at once arise, Are there any limits to this interaction? It is just here that parties divide. A scientific physician will affirm that even in certain organic diseases, where perceptible changes have gone on in the tissues, nature can effect in her slow but steady way most wonderful repairs. But that there are limits even to the powers of nature, is equally well proven. He therefore cannot believe that mental action, however strong, can restore an organ which is hopelessly destroyed, or can hasten the process of repair to such an extent that in an instant changes are produced which ordinarily require weeks. He is, however, familiar with the fact that many diseases whose mental effects are as evident and distressing as in the former class are not attended with organic change; that in these the organ lies quiescent, ready to do its work at any time under the proper stimulus; and that here an instantaneous cure of the disease is possible under certain circumstances. In a word, he believes that functional diseases may yield to mental influences, but that organic diseases cannot be greatly modified by them. On the other hand, the 'Christian scientists,' among whom Miss Titcomb may be classed, do not admit this distinction. Taking for granted the existence of thought-transferrence, they hold that "the cure of disease is affected by the idea of health becoming, unconsciously to the sick person, the dominant idea in the sick person's mind by transferred thought. Thus the mind-curer's mind is concentrated upon the idea that the sick person has no disease; and this idea being transferred from the active brain of the mind-curer to the passive brain of the sick person, it becomes there the dominant idea, and the sick person becomes well" (p. 13). A number of successful cases are related (pp. 46–48), but in none of them are there inherent evidences of the existence of organic disease. Asthmatic attacks, as is well known, come on at night, and pass off in the morning. It proves nothing, therefore, to state that such a patient was treated in the evening, and "when visited the next day was found to have recovered entirely" (p. 49). Further, "A gentleman residing in the same street with the writer was very ill with Bright's disease. He had been delirious for weeks, and all hope of his recovery had been abandoned. On passing the house one day, the writer gave the patient, whom she had never seen, a 'treatment.' She found afterward, upon inquiry, that the patient had recovered from his delirium almost immediately after the treatment was given. She continued to treat the patient, unknown to him or his family, for a fortnight, when she learned that he was able to be up and about the house" (p. 50). Now, aside from the facts that delirium rarely occurs in Bright's disease, and never 'for weeks,' and that the majority of cases recover spontaneously, according to a high authority, the query arises, whether the 'treatment,' which was given in this manner, had as much effect as the medicines the man was probably taking — especially as the 'treatment' seems to have consisted simply in a 'concentrated thought' on the part of a party unknown to the man. This reminds us of the tales of witchcraft, with a somewhat heightened degree of improbability. *Post hoc* with Miss Titcomb is equivalent to *propter hoc*. But a sober criticism will not hesitate to condemn such statements, because they assume not only the universal action of 'unconscious cerebration,' but also the possibility of general thought-transferrence, — a fact which is disproved both by the English and more strongly by the American society of psychical research (*Science*, July 3, 1885). If the logic of such reasoning is questionable at the start, the conclusions are hardly worthy of a mention. But this is a fair sample of much of the reasoning which has resulted in so-called explanations of the mind-cure. Start with a theory not based on facts to explain certain phenomena which have not been established as facts. It is evident that for an explanation of mind-cures we shall have to seek further.

That there are authenticated cases of sudden recoveries from serious affections of a functional nature, is admitted by all. That the intimate connection of mental and bodily action in health and disease exists; that such connection has a basis in anatomical structures, which are chiefly nerve-fibres; that nervous influences may pass over these fibres from the organ to its corresponding brain area, or in the opposite direction; and that under great mental strain or excitement the passage of such influence may be either suspended or greatly increased in intensity, producing unexpected effects at either end of the transmitting-fibre, — are facts which are proven by experiment and observation. To go beyond the facts is to venture into a maze of theories, none of which can satisfy a logical mind.

A. M.

LAYING A CABLE.

It was not much of a cable, after all, and its laying was no great performance, although forty years ago it might have been considered a marvel.

Science, in its so-called practical aspects, is now advancing in parallel lines; and these are so numerous, and some of them so far-reaching, that most men are unable to follow along more than one or two. This fact has suggested the idea that there may be something of interest to many in a description of this cable, and of the operation of putting it in the water.

It does not connect us with any foreign country; it does not complete the girdle round the earth: it is modestly content to serve as the link which joins the intelligence of the rest of the world with that of the interesting and important islands, Martha's Vineyard and Nantucket, where formerly the influence of the whale prevailed over all else, but now, alas! tributary to the state of Massachusetts, from which comes good government, and to the Standard oil company, from which comes petroleum, that arch enemy of the whale trade. But exclusiveness, even when aided by insulation, must give way to the progress of events. A glance at the map will show the nature of the forces operating in this case. Vineyard Sound is the great highway of the coasting trade. Thousands of vessels of all kinds pass through it every year. The harbors of Vineyard Haven (correctly named), Tarpaulin Cove, Lambert's Cove, etc., afford shelter for hundreds during rough weather. Wrecks are, unfortunately, not infrequent; and a visitor from the outside world is likely to see in the simple but perfectly neat and thrifty-looking home of the fisherman-farmer a carved and upholstered chair, or something of the kind, which is referred to with no little pride as a relic from the wreck of some passenger-steamer which went ashore with the loss of many lives and much property upon the coast near by.

The principal and sufficient reason for asking for a special appropriation from congress to secure telegraph communication with the mainland, was that stations of the U.S. signal service might be established on the islands, and particularly that danger-signals might then be displayed from the more prominent points for the guidance of the numerous sailing-craft constantly passing through the sound. Some years of effort were rewarded with success at the last session, an appropriation of forty thousand dollars having been made for the purpose of laying the necessary cable, amounting in all to less than thirty miles, and for erecting the land-lines, display-stations, etc. The work has been done, therefore, under the direction of the chief signal-officer.

The cable was made in London, and shipped to New York in the hold of a steamer, coiled in two large tanks especially built in the steamer for that purpose. It fortunately happens that the gutta-percha insulation, used almost exclusively for submarine cables, is improved and preserved by being kept damp, cracking and deteriorating when dry. For this reason it is necessary to keep the cable in tanks during its passage, so that it may be kept covered with water. The conducting part of the cable consists of seven copper wires, each about .028 inch in diameter, six being twisted about the seventh as a centre. The resistance of this conductor was not to exceed thirteen ohms per nautical mile, and it fell considerably short of that upon being measured. This copper core was covered with three or four layers of gutta-percha, until the diameter of what might be called the cable proper was a little more than a quarter of an inch. Such a cable would scarcely last while it was being put down, and it is therefore necessary to put an 'armor' upon it, so that it may be able to endure the destructive agencies to which it is likely to be subjected. The gutta-percha-copper core is wound with two or three layers of heavy jute twine, and this, again, with twelve number five galvanized iron wires laid on spirally. The result is apparently a strong iron rope about an inch and a quarter in diameter.

An examination of the cable was made in New York City, before its removal from the tanks referred to, for the purpose of seeing that its insulation was still intact. It was then transferred to a barge lying alongside, from which it was to be laid, and in which it was towed through the sound to Vineyard Haven. Its arrival at this place caused little less than a sensation. The first section of the cable was to be placed across Vineyard Sound; and, although not the longest, it was the section likely to cause the greatest anxiety. In fact, the Western union telegraph company has several times tried to place and maintain a cable from West Chop light on Martha's Vineyard to Nobska Point on the mainland, but their efforts have not been altogether successful. The damage to a cable across the sound arises from two sources. The tidal current is strong, at some points nearly three miles per hour; the seaweed, which is carried back and forth by this current, is caught on any suspended or exposed part of the cable, and twisted around it until huge, solid masses are attached to it, which offer so much surface to the swift current that the cable must give way under the strain. The other source of danger is quite as disastrous, and nearly as uncontrollable. It

is in the dragging of ships' anchors across the line of the cable. In this way the cable is caught in the anchor and brought to the surface when the latter is hoisted. A little intelligence combined with good nature would enable the shipmaster to release the cable and drop it uninjured; but more frequently, in his annoyance, he will deliberately cut it in order to escape, although release without injury could be accomplished in less time. In putting in this cable, it was desirable to locate it so that the chances of damage from both of these sources might be reduced to a minimum. To this end the officers in charge of its laying did not need to seek advice from persons familiar with the waters, for it was freely offered by every inhabitant of the islands. The multitude included a few old sea-captains, who seemed to know every foot of the coast, and to understand the nature of the bottom of the sea; and it is believed that their words were words of wisdom. The route selected lay across the sound several miles to the westward of that already referred to. It is undoubtedly freer from probable damage arising out of the anchorage of vessels, but time alone can determine to what extent.

Every thing being in readiness, the barge was towed to the starting-point, which was the northern terminus of the cable on Naushon Island. As there was a good deal of a 'sea' running, it was not possible to approach nearer than twelve hundred or fifteen hundred feet from the shore. The tug was anchored, and the barge was allowed to drift in a few hundred feet farther. A stout rope an inch and a half in diameter was then attached to the end of the cable, eight or ten men were put into a boat, and the other end of the rope was carried ashore. The end of the cable was dropped overboard, and the operation of pulling it to the beach began. This was finally successful, and the shore end was made fast to a stout post which had been erected for the purpose. All hands came on board, anchor was weighed, the barge made fast to the tug, and the journey across the sound was begun. The cable lay in two great coils in the barge, and dropped into the water over the stern. It passed around and over a couple of large reels or drums, where a large pulley-brake was applied to it in order to regulate the tension to which it was subjected. To one of the drums a counter was attached, so that the rate at which it was paying out could at any time be determined. Wind and tide opposed each other, and the rate of sailing did not exceed five or six miles per hour. The opposition of wind and tide was favorable to a straight course, and good pilotage secured a run across which undoubtedly put the cable down in almost exactly a straight line from the point of departure to the southern terminus on Martha's Vineyard. At this end the landing was a little more difficult. A rope was first carried ashore, its length measured as it went out, to determine where to cut the cable that it might reach the beach from the anchorage. On its next trip the little surf-boat carried a small, weather-worn 'A' tent, a rough bench, batteries, galvanometers, resistance coils, and two shivering signal-service men, who were to test the cable as soon as it was landed. A rude testing-station was soon established amid the hillocks of sand, and the instruments were in position when the cable was at last landed, and secured to a portion of the wreck of an unfortunate vessel that had stranded upon the shore many years before. But the high winds were still rising, darkness was coming on, and the captain of the tug, declaring that he had had enough of cables for one day, ordered all hands on board forthwith. It was impossible to leave the instruments in that condition, and the prospects for a night on the beach seemed good, when the hospitality of the owner of the one house within sight brought relief, furnishing a storehouse for the appliances, a well-supplied table for keen appetites, and a wagon-ride at night through the woods to the hotel, seven or eight miles away.

On the following day the termini were again visited, the ends properly secured, and the cable tested. A trench was dug in the sand down to low-water mark, in which the cable was buried. At a point above high tide on the beach a strong post was erected, to which the cable was secured by means of a heavy chain; from which point, still underground, it was carried higher up the sand-hills on which it had been landed, to the foot of an ordinary telegraph-pole. It extended up the side of this, being enclosed in a box until it reached the top, where it entered the cable-box proper, the end being secured to a binding-screw ready for connection later with the land-line. Some of the party had been sent to Naushon Island, carrying with them an ordinary telegraph instrument and key. By previous agreement it was to be connected with the cable at once on the arrival of the party. A few cells of battery and a similar instrument were joined to the end on Martha's Vineyard, and the two expeditions had been timed so accurately that almost instantly responsive ticks proved that intelligence was at work on the other side. Much interest is often felt in the first message transmitted through a cable or telegraph line. Brushing aside the romance of the thing, it is safe to say that in nine cases out of ten the first message is that which traversed the river first on this occasion, being

simply, 'Do you get me now?' After some further interchange of compliments, the operator on Naushon was directed to seal up the end of the cable by covering the exposed wire with gutta-percha. This having been done, communication ceased, and the insulation was tested. A number of battery cells were joined 'in series' to the galvanometer, which was a delicate instrument of high resistance, with a reflecting mirror, and to this the end of the cable was attached. The test was practically an endeavor to force the current through the gutta-percha insulation, the amount of the leak being measured by the deflection of the galvanometer needle. It had been demanded of the cable that it should show an insulation resistance of at least two hundred and fifty meg-ohms per mile, and it greatly exceeded this number when tested.

A few days later, when wind and weather were favorable, the island of Nantucket was connected in a similar way with Martha's Vineyard, the cable taking a sweep out into the sea to avoid shoals; and finally a short piece, about a mile in length, was made to connect Naushon, by way of the little island Uncatena (always 'Uncle Timmy' at home), with Wood's Holl, and thus was completed the union of these islands with the mainland, which it is hoped may last for many years.

M.

PHYSICS AT JOHNS HOPKINS.

THE large and well-appointed laboratories recently erected by the trustees of the Johns Hopkins university for the chemical and biological departments have by contrast made the more evident the needs of the physical department, which has been obliged to occupy temporarily parts of four different buildings. The trustees, recognizing this need, are now erecting a building for a physical laboratory. The new laboratory is to be a handsome building of red brick, trimmed with brown sandstone, and will occupy a fine site about a block from the other university buildings, on the corner of a quiet little street midway between the more important streets, which carry the bulk of the traffic of that region. It will therefore be as free from disturbance from the earth vibrations as could be expected in a city.

The building will be 115 feet long by 70 feet broad, and will have four stories besides the basement. In the centre of the building, and below the basement, are several vaults for instruments requiring to be used at constant temperature, also a fire-proof vault for storage. In these vaults will be placed Professor Rowland's dividing-engine, by which the diffraction gratings are ruled, and the Rogers-Bond comparator, which has recently become the property of the university. In the basement will be rooms for the mechanical workshop, for furnaces, and for piers for instruments requiring great stability. The first floor will include the main lecture-room, which will accommodate 150 persons, and rooms for investigations by advanced students in heat and electricity. The second floor will contain mathematical lecture-rooms, studies for instructors, and a room for the mathematical and physical library of the university.

The elementary laboratory will be on the third floor, which will also have rooms for more advanced work. The fourth floor will contain rooms for special work in light.

There will be a tower on the south-east corner of the building, which will have two rooms above the fourth floor. The upper of these will be provided with telescope and dome, and will be a convenient observatory when great steadiness in the instruments is not required. There will be power in the building for driving the machinery in the workshop and for running the dynamo-machines. A large section of the building is to be made entirely free from iron. The sash-weights will be of lead, and the gas-pipes of brass. Brackets will be attached to the walls, on which galvanometers and cathetometers may be placed. In order to avoid the inconvenience of having piers go up through the lower rooms, and yet to secure steadiness, beams have been introduced into the floors, which reach from one wall to the other between the regular floor-beams, and do not touch the floor at any point. If, now, a table is made to rest on two of these beams, by making holes in the floor over them to admit the legs of the table, it is entirely undisturbed by any one walking over the floor, except by such motion as is transmitted to the walls. There will also be a small vertical shaft in the wall of the tower, running from top to bottom, in which a mercurial manometer may be set up.

The vaults for constant temperature have been built with double walls, so that a current of air may be drawn between them whenever desirable to prevent dampness. It is expected that the laboratory will be ready by October next.

The photographic map of the spectrum, upon which Professor Rowland has expended so much hard work during the past three years, is nearly ready for publication. The map is issued in a series of seven plates, covering the region from wave-length 3100 to 5790. Each plate is three feet long and one foot wide, and contains two strips of the spectrum, except plate No. 2, which contains three. Most of the plates are on a scale three

times that of Angström's map, and in definition are more than equal to any map yet published, at least to wave-length 5325. The 1474 line is widely double, as also are b_3 and b_4, while E may be recognized as double by the expert. In the region of the H line these photographs show even more than Lockyer's map of that region. Negatives have also been prepared down to and including the B group, and they may be made ready for publication, one of which shows eleven lines between the D lines. A scale of wave-lengths is printed on each plate, and in no case does the error due to displacement of the scale amount to one part in fifty thousand. The wave-lengths of over 200 lines have been determined to within one part in five hundred thousand, and these serve as reference lines to correct any small error in the adjustment of the scale. The great value of such a map lies not only in the fact that it gives greater detail and is more exact than any other map in existence, but that it actually represents the real appearance of the spectrum in giving the relative intensities and shading of groups of lines so that they are readily recognizable. The photographs were taken with a concave grating six inches in diameter, and having a radius of curvature of $21\frac{1}{2}$ feet, and the photographs were taken when the plate was placed directly opposite the grating; both the sensitive plate and grating being perpendicular to a line joining their centres, and placed at a distance apart equal to the radius of curvature of the grating, the slit being on the circumference of the circle, whose diameter is the distance between the grating and plate. With this arrangement, the spectrum is photographed normal for wave-lengths without the intervention of any telescopes or lens systems; and a suitable scale of equal parts applied to such a photograph at once gives relative wave-lengths.

Few persons have any idea of the perseverance and patience required to bring such a task to a successful issue. More than a year was devoted to preliminary experiments designed to discover the best mode of preparing the plates for the particular regions to be photographed. Hundreds of preparations were tested to find their influence on the sensitized plate, and the whole literature of photography was ransacked, and every method tested to the utmost, before the work of taking the negatives could begin.

The Rogers-Bond comparator, which has been already referred to as having been purchased by the university lately, is one of two instruments that were constructed in 1881 by Pratt & Whitney of Hartford, Conn. The general plan and requirements were made out by Prof. W. A. Rogers of Cambridge, and the drawings and details were worked out by Mr. George M. Bond, then a student at Stevens institute. The comparator was designed for making exact comparisons of standards of length. The other similar comparator is owned by the Pratt & Whitney manufacturing company, and is used by them in testing and constructing their standard gauges.

The instrument consists essentially of two microscope carriages, which slide on two parallel cylindrical steel ways between stops, which may be clamped at any point. A carriage entirely independent of the ways on which the microscopes slide, supports the two bars to be compared, and is provided with means of accurate and rapid adjustment, by which the bars may be successively brought into position under the microscopes, and the lengths compared by the micrometers attached to the microscopes; or one microscope only need be used, and slid first against the stop at one end, and then against that at the other end. The instrument also affords great facility in determining fractions of a given length with any desired degree of precision. The instrument is one requiring the utmost skill in its construction, and it cost several thousand dollars to make it. A full account of this remarkable instrument is given in the Proceedings of the American academy of arts and sciences for 1882–83. K.

NORTH CAROLINA COAL-FIELDS.

THE coal-deposits of North Carolina have recently been examined by Dr. H. M. Chance,[1] under the direction of the North Carolina state board of agriculture, with the view of determining their commercial value.

There are two isolated triassic areas in North Carolina in which coal has been mined, — one on Deep River, and the other on Dan River. Dr. Chance's explorations in the Deep River coal-field consisted mainly in a re-examination of the coal outcrop, which follows the west border of the area, and passes through Farmville, Gulf, and Carbonton. The various sections obtained show that in general there are two workable coal-seams in this field, as was proven long ago in the Egypt shaft and at several mines along the coal outcrop. The upper seam averages 2.5 to 3 feet, and the lower 2 feet in thickness. In the Egypt shaft the upper coal measured 4 feet, and the lower 1 foot 10 inches; twenty-seven feet below the lowest of these workable seams, another, 1 foot thick, was penetrated. At Gulf three workable seams outcrop, but their thickness is variable owing to

[1] *Report on the North Carolina coal-fields to the department of agriculture* [of North Carolina]. By DR. H. M. CHANCE. Raleigh, 1885. 66p., 3 maps. 8°.

disturbances due to trap-dikes and faults. The dip of the coal-seams is in general S. E. 25–30°.

Several new analyses of the coal of this area are presented, some of them being of average samples from large quantities. The coal is 'bituminous,' as is shown by the following average of a large number of analyses: volatile matter, 30; fixed carbon, 54; ash, 12; sulphur, 3.6 per cent. At times the coal has been altered to a semi-anthracite, and even to a natural coke, by the heat of trap-dikes.

The expense of working the coal in seams 2 feet thick is estimated at $1.50, and in seams 3 feet thick at $1.20, per ton. In the mines of Tennessee and West Virginia, with which the North Carolina coal comes in competition, mining is carried on at the rate of about 65 cents per ton. Combining these figures with the cost of transportation, it is shown that there would remain a sufficient margin in favor of Deep River coal to command the market in eastern North Carolina. This is favorable to the development of the Deep River deposits: still the fact that these mines have not been worked for many years is significant.

The Richmond coal-field, which is of the same age and of the same general character as the Deep River deposit, but in which coal occurs in much thicker seams, and in general is of better quality, has also been a failure, when the mining operations of the whole field are considered. It is evident, therefore, that there must be some sufficient reason why mining in these fields, which are in close proximity to good markets, has not succeeded. Dr. Chance enumerates some of the more obvious difficulties that present themselves in the Deep River area: there are variations in the thickness and quality of the seams, faults, trap-dikes, presence of explosive gas, water, spontaneous combustion, and absence of coal from certain areas. Nearly all of these obstacles are probably much more difficult to surmount in these mines than in the great coal-fields to the west, with which the North Carolina coal comes in competition. To the present writer, who has recently examined all of the triassic areas south of the Potomac, it appears that the difficulty in the way of economical mining in the various triassic coal-fields arises mainly from the structure of the deposits. All of these areas are extensively faulted, and are traversed by an extended system of trap-dikes. Along the faults the coal has been so completely crushed that it is usually of little commercial value. At the same time, the continuity of the beds has been broken, and their dip disturbed and rendered irregular.

This wide-spread disturbance renders the expense of working the coal extremely uncertain, mainly on account of the difficulty of following faulted beds. The numerous trap-dikes that intersect the triassic areas north of the Potomac have caused disturbances which are even more injurious to the coal-deposits than the effects of faulting. The dikes are frequently accompanied by a displacement of the beds on either side, and also by an alteration of the adjacent coal. At times the coal in proximity to the dikes has been ruined by the heat; but in some instances, however, a natural coke has been produced which is more valuable than the unaltered coal. Trap-dikes more than a few feet thick are so expensive to penetrate that they are practically insurmountable obstacles when met with in coal-mines. This was the case in certain mines formerly worked at Gulf. Again, the trap sometimes penetrates the coal-bearing strata in intrusive sheets, approximately parallel with the planes of bedding, and in these even more troublesome to the coal-miner than when it forms vertical dikes.

A study of the numerous mining operations that have been carried on, commonly with failure, in the Richmond coal-field, would illustrate the peculiar difficulties to be expected in the Deep River basin. The lack of success in so many mining ventures in the triassic areas south of the Potomac, owing to the disturbances that have affected the coal, proves conclusively that mining should not be undertaken in the triassic coal-fields of the south without a careful preliminary examination with a diamond drill of the entire property that it is proposed to work. The quantity, quality, and position of the coal should be accurately determined before expensive mining operations are begun. With these precautions, it is probable that portions of the Deep River coal-field can be developed with profit, but it is safe to predict financial failure for those who begin mining with the expectation of working continuous coal-seams in the manner followed in West Virginia and Pennsylvania.

The coal-deposits on Deep River were also examined by Dr. Chance, who pronounces them to be valueless for commercial purposes.

This report will be of value to those interested in the coal-deposits of North Carolina, but it contains little that can be considered as a contribution to geology. I. C. RUSSELL.

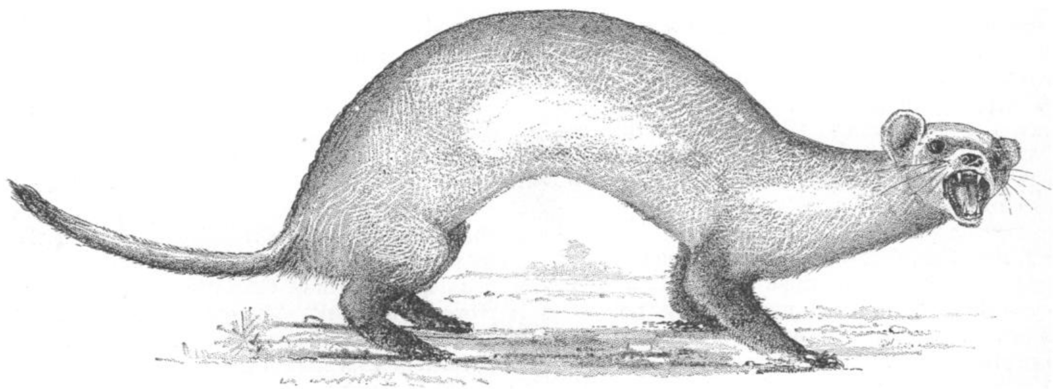
THE AMERICAN FERRET.

ALTHOUGH the philosophical biologist measures the importance of a species by the light it throws upon the problem of the science which he cultivates, there are certain animals and plants which, while not intrinsically of unusual importance, enjoy a special prominence on account of their

brilliant coloring, the grotesqueness of their form, or their rarity. A rare species has the same interest for a collector of natural objects as a rare book for a bibliomaniac. Be its importance real or nominal, its rarity recommends it, because men tire of that with which they are familiar.

The American ferret (Putorius nigripes, Audubon and Bachman), of which we offer a representation, is one of the least known of North American mammals, and is but rarely met with in collections. It was described by Audubon and Bachman in 1851 from a single specimen, and a quarter of a century passed before our knowledge of the species was in any wise augmented. In 1874, Dr. Coues advertised his desire for specimens in certain sporting papers, and was gratified to receive for the Smithsonian institution several examples from different localities.

Since that time quite a number of specimens have accumulated in the national museum and some other establishments.



THE AMERICAN FERRET.

Of the habits and distribution of the black-footed ferret, we still know very little. The specimens thus far recorded are from Texas, Kansas, Nebraska, Colorado, Montana, and Wyoming. The species probably ranges over the greater part of that section of the United States lying between the Mississippi River and the Rocky Mountains.

The specimens of which the history is known were taken from prairie-dog holes; and Dr. Coues states that about Fort Wallace, Kansas, the species is said to be known as the 'prairie-dog hunter.' Dr. Hayden found the remains of a prairie-dog in the stomach of a ferret which he sent to the Smithsonian institution.

In his work upon the weasels, Dr. Coues established a special sub-genus, Cynomyonax, for the black-footed ferret, and in 1881 Hensel made the species synonymous with the Putorius Eversmanni of Siberia. It seems very improbable, however, that Hensel's view is correct.

The specimen figured was obtained for the Smithsonian institution by Capt. James Gillis, at Cheyenne, Wyoming. The head and body measure 19 inches (following the curves); the tail, including the terminal pencil, 5½ inches. F. W. TRUE.

A CLERGYMAN has just been committed to prison in England for seven days as a penalty for striking a constable. The assailant was coming out of his house, when the policeman, who happened to be waiting to serve a summons, laid the document on his arm. His reverence exclaimed, "You brute, how you did frighten me!" and struck the constable a violent blow in the face with a candlestick. In commenting on this case, the *Lancet* says that it should not be forgotten that in many instances the immediate effect of a 'fright' is to make the person startled strike out with any thing at hand. Some persons are paralyzed by panic: others are instantly roused to action in a way that does not involve volition. The blow is as much the result of the excitation as the knee-jerk produced by striking the patellar tendon, albeit the train of actions is more complex, and involves the exercise of that co-ordinative faculty which has been called the sub-consciousness. In stumbling we make certain movements with the feet, and clutch at any thing that may be within reach in a manner designed to prevent or minimize the effect of a fall. A good horseman will, 'instinctively,' as we say, take such precautions as will prevent his being hurt by a fall. The will is not *intentionally* active in these processes. The recognition of the danger, and the adoption of suitable measures, seem to occupy too short a time for thought.